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ABSTRACT

A cognitive, theory-based assessment-intervention model of social-communicative development and research to validate the model are described in this document. The model is neo-Piagetian in that it assumes that social-communicative skills are structured by cognitive skills and that these skills follow a five level sequence of stages. The assessment instrument component of the model which reflects this sequential structure, is directed at three major problems associated with readiness to acquire a rule-governed language system: (1) gaining attention to oneself; (2) directing attention to an object; and (3) regulating another's behavior to achieve a desired goal. A sample of 39 handicapped children ranging in age from 8 to 42 months was assessed using both object and social-communication scales, as well as the Bayley Motor and Mental Scales. Chronological age (CA) was only modestly correlated with both the object measures and the social communication measures. A low correlation was found between physical age and communication level and a strong relation was found between object scores and social-communication scores. These results indicate, as predicted, that developments in the object and communication domains are related in a structural way that is distinct from a more general developmental function reflected in CA. A series of other analyses lend further support to this conclusion. The model and these results are discussed in terms of implications for intervention.
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Developmental Assessment based on a Structural Stage Model of Early Communication Development: Some Theoretical, Methodological and Practical Issues

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Developmental Assessment based on a Structural Stage Model of Early Communication Development: Some Theoretical, Methodological and Practical Issues[1]

Jeffrey M. Seibert, Ph.D.

I. Introduction: Why Another Developmental Assessment Instrument?

As programs of early intervention become more widespread for infants and toddlers who are at risk for developmental disabilities or already manifest such disabilities, discussion about the effectiveness and expected outcomes, both long and short term, of such programs continues (for an extended discussion, see Bricker, Seibert, & Scott, in press). In a recent chapter, Scott (1978) has suggested that, in any such discussion, a distinction must first be made among three general models that characterize the nature of these early detection and prevention efforts: the Diagnosis-Treatment Model, the Ability-Enrichment Model, and the Assessment-Intervention Model.

The first, the Diagnosis-Treatment Model, is the oldest, arising from a medical orientation that considers disabilities to reflect an underlying disease entity that requires medical intervention or treatment. Given the broad range of disabilities for which etiology may be unknown and this model's focus on syndromes to the neglect of normal development, its appropriateness as a general approach to detection/prevention appears limited. The second general model is the Ability-Enrichment Model, which considers disabilities in the context of deviation from the population norm on some pervasive trait such as intelligence. General compensatory stimulation or enrichment, through a supportive social-educational

environment, is the means by which programs based on this approach attempt to remediate the perceived trait deficiencies. Head Start programs, at least as originally conceptualized, have exemplified this model in their typical implementation. Many methodological problems surround the evaluation of this model, which generally fails to specify the nature of the content of the intervention and only vaguely defines desired outcome in terms of changes in standardized test scores.

The third general model, and the preferred model for programs for the developmentally disabled according to Scott (1978), is the Assessment-Intervention Model. Within this framework, assessment is closely linked to intervention. The assumption is made that desired outcomes should be reflected in the assessment instruments and that they can be described in terms of specific skills or concepts laid out according to developmental sequences or task-analyzed into components. Specific intervention can then be designed to foster the acquisition of these component skills and sequences of behavior.

That the assessment-intervention model has become the preferred model for intervention programs for the handicapped child can be determined by an examination of the program evaluation guidelines recommended by the technical assistance component of the national network of B.E.H. First Chance Projects, funded under the Handicapped Children's Early Education Program Act of 1968; or by a review of program standards for the operation of child training programs established and funded through various state agencies (e.g., see State of Florida's Program Standards for Child Developmental Training Programs, 1978).

In such programs of early intervention, the Assessment-Intervention Model has typically been implemented by first selecting a set of assessment scales such as the Bayley Scales of Infant Development (Bayley, 1969) or, where a specific skill area such as communication is the focus, an instrument such as the Sequenced Inventory of Communication Development (Hedrick, Prather, & Tobin, 1975) which are composed of developmental milestones sequenced according to typical ages of mastery. In some cases, rather than using such standardized tests, some intervention projects have developed their own measures (e.g., Down's Syndrome Performance Inventory, by Hayden & Dmitriev, 196 ; Prescriptive Learning Accomplishment Profile, by Sanford, 1974; Portage Guide to Early Education, by Bluma, Shearer, Frohman and Hilliard, 1976; Uniform Performance Assessment System, by White, Edgar, & Haring, 1978) which, nevertheless, appear to derive most of their items from available standardized tests such as the Bayley, or other infant intelligence tests. The scales are then administered to each child in the program to determine current level of functioning so that interventions can be designed to foster acquisition of subsequent skills listed in the assessment. Yet with this proliferation of project-developed measures, noted, not uncritically, by Johnson & Kopp, (1980), we propose in this paper yet another developmental assessment instrument to direct intervention decisions, specifically in the area of social-communicative development. Why, anyone might legitimately ask, <u>another</u> assessment instrument?

The answer, and our justification, can be found by an examination of several assumptions implicit in the Assessment-Intervention Model that need to be made explicit. Effective use of the model assumes first of all that

all or most of the desired outcomes of intervention are known; secondly, that the sequences of developmental prerequisites for these outcomes are known; and third, that the appropriate experiences to foster these outcomes are known.

Obviously, given the state of knowledge in the field of developmental psychology, all of these assumptions, at some level, can be challenged. That, however, does not invalidate the appropriateness of the model. It simply suggests where further research is needed.

Related to this state of affairs, our position is that most available developmental assessment instruments, while representing a very important initial step in articulating the content focus of intervention efforts, are nevertheless inadequate for the task of directing decisions about intervention. Perhaps it is simply a matter of degree, but we believe that more useful information about processes of development exists than is represented in most available assessment scales available to interventionists. More specifically, we believe that a well-articulated theoretical model of developmental processes should underlie the assessment-intervention approach. We are led to this position because we believe, based on clinical observations, that without an appreciation of the underlying processes that are tapped by the surface milestone behaviors of our assessment instruments, our interventions may be less than effective, or even counter-productive.

Criticism against most of the currently available standardized, norm-referenced assessment instruments is perhaps unfair, since their function is more to document developmental delays and, in some cases, attempt to predict future performance, than it is to provide a basis for prescriptive

educational planning. But such instruments, and derivations of them, have been all that, in general, has been available to the practitioner looking to implement the assessment-intervention model. Such scales have been empirically derived, relatively independent of any specific theory of child development and component developmental dimensions, to provide group norms for acquisition of developmental milestones against which an individual child's rate of development can be compared. These instruments are valuable for documenting delay, but the interventionist must make several not so explicit steps in order to translate the test information into a meaningful picture of what exactly the child understands and what he needs to master next. Simply training the developmental milestones that these scales are comprised of, without understanding which skills are interrelated and what underlying processes and concepts they are indexing, may be an inefficient use of time and resources. For example, it may be that the skills represented by some of the milestones are <u>precursors</u> of later skills but are not necessarily developmental <u>prerequisites</u>. In such cases, training on a "milestone" behavior may have little appreciable effect on the child's achievement of a later important skill or concept. An experienced clinician may understand the interrelationships among items and underlying concepts indexed on the available scales, but what is needed is a set of scales that is organized in such a way that it makes these relationships an explicit part of the instrument.

To understand more concretely the kind of problems that using a theory-free assessment as a basis for intervention may lead to, consider the following situation, not uncommon in early intervention settings. Based

on a developmental assessment, stacking cubes, a common milestone across assessments, may be targeted as an objective for a particular child and taught simply by physically prompting the child to stack the cubes. Such an intervention strategy may be appropriate if the focus is on the fine motor skills involved in voluntary release and the perceptual-motor skills involved in placing one object directly above another. However, if the goal is for the child to learn something about spatial relationships among objects and the role of gravity, which involve concepts rather than specific motor skills, the approach to training these concepts may be considerably different. A greater variety of materials and situations would be employed and child-initiated activity would be encouraged rather than teacher-directed physical prompting. Stacking blocks is included on most developmental assessments, not because it is an essential skill in itself, but because it reflects the spontaneous behavior typically observed in children around this age who are mastering these spatial concepts. With an understanding of the process, stacking cubes will not be taught only as a motor skill.

Few available assessments are designed to provide the user with insight into the underlying process and organization tapped by the behaviors represented in the scales. Notable exceptions are Piagetian ordinal sensorimotor cognitive scales (e.g., Escalona & Corman, no date; Uzgiris & Hunt, 1975) which include many behaviors that overlap with other infant assessments, but provide a theoretical interpretation both for individual items and for sequences of items. Such scales, we believe, approximate more closely the kind of intervention-linked assessment instrument needed.

Therefore, we reiterate that a need still exists for developmental assessment instruments, but for instruments grounded in a comprehensive theoretical model. One of our goals, to which the remainder of this paper is addressed, is the articulation of such a theoretical model for the developmental processes involved in the emergence of social/communication skills leading to symbolic (i.e., linguistic) communication, analyzed from a cognitive perspective. This model has provided the framework for constructing a social-communication assessment instrument that in turn links directly to intervention decisions about curriculum and programming. As noted earlier, all the information to do this is not currently available; the reciprocal interplay between the theoretical and the applied is seen as an essential ingredient of this research endeavor. While the theoretical model is directing the construction of the instrument, data derived from administration of the instrument reflect back on the validity of the model.

Before considering the model and the assessment instrument, it may be of value to note first what issues our research is not currently addressed to and what are not intended functions of the assessment scales. Research is not currently concerned with the question of the effectiveness of any intervention, either short-term or long-term, derived from the theoretical model. The predictive validity of the instrument to the future development of intelligence or language and the related issue of individual differences are also not presently being addressed, although these are important issues that must eventually be considered. The aim rather is to construct an assessment instrument that taps skills and concepts that have face validity, whose acquisition, at least within a

handicapped population, can not be taken for granted. From this pragmatic orientation, while relative rates of mastery of these skills may not necessarily be predictive of future relative status in the population at large, items are selected to reflect social and communicative skills that every competent two-year old should display. A child deficient in these skills is certainly in trouble. These disclaimers should not be interpreted as a concession that we do not expect the instrument to have any predictive validity, but only that we feel that a concern with that issue is premature for us in the context of where we are in developing the scales. Further articulation at a descriptive level for these intervention domains is required before prediction to later developments becomes a research objective. Our current goal, in other words, is to construct edumetric rather than psychometric measures, according to the distinction offered by Carver (1975).

The assessment instrument itself is not intended to evaluate the sensory intactness, preferred modality, or motor pathology of an individual. We recognize that these will be concerns of anyone attempting to assess or intervene with a child in communication-related areas. However, inclusion of appropriate measures to provide information on these concerns in our inventory would make the assessment procedures prohibitively cumbersome. Therefore, an appropriate therapist should be consulted if concerns in these areas exist. The instrument is designed to look at those processes that should be developing regardless of handicapping condition. However, in the instrument's initial phase of development, borrowing from the normal developmental literature, items are often described in terms of the behaviors of normal infants, leading to the inclusion of many items tested

in the visual modality and making the scales less appropriate currently for children with no functional vision.

II. The Theoretical Model

There are four major aspects of the theoretical model to be addressed; these include a structural assumption, a conceptualization of developmental dimensions, a stage or level assumption, and the hypothesized role of experience in development. The model first of all is a structural one; it assumes that a child's behavior and mode of interaction with his environment at any point in development can be described according to some organizational principles. As Wohlwill (1973) remarks, this simply means that, by knowing about certain aspects of a child's behavior, we can with a good deal of confidence make predictions about other aspects of his behavior that we have not yet observed. The basis for this organization of behavior at any point in development is no doubt a reflection of the underlying organization of the nervous system, and in the area of cognitive or problem-solving behaviors, probably a reflection of organization at a cortical level, but this probable neurological link is not central to an understanding of the model.

More specifically, the theoretical model proposes that early social interaction and communication skills can be conceived of as cognitive skills focused on people that, at some general level, share an organizational structure with cognitive skills focused on objects (skills encompassed by the traditional Piagetian sensorimotor domain). The term domain will be used through the remainder of the paper to refer both to the set of cognitive skills with persons and the set of cognitive skills with objects.

Concretely, a common organization underlying both domains means that, with an opportunity to observe a young child's adaptive interactions only with objects, one will be able to make, with reasonable accuracy, a prediction about what his social and communicative interactions with people will be (or vice versa). This broad conceptualization of cognition to encompass adaptive or problem-solving interactions with both persons and objects, while consistent with Piaget's theory, has been more explicitly articulated by Fischer (1977) in a recent theoretical paper that has influenced the elaboration of our own theoretical framework. This broad approach to cognition is also reflected in the recent empirical and theoretical writings of Uzgiris (1976, 1977) and McCall (McCall, Eichorn & Hogarty, 1977). The cognitive focus to communication is quite compatible with the increasing emphasis on pragmatics in developmental psycholinguistics, which focuses on the functions of language and how language use affects its form (e.g., see recent issues of the Journal of Child Language).

The second assumption of the theoretical model is that development in each of the domains can be conceived of as consisting of multiple related but distinguishable dimensions that develop over time and that reflect different aspects of a child's adaptive interactions with objects and persons. This division of the major domains into component developmental dimensions is necessarily somewhat arbitrary and reflects to a degree the practical concerns of the investigator making these decicions. The identity of the dimensions will also reflect the particular developmental level that is being used as the reference or end point in describing the developmental sequences. In the case of our own research, the transition

between the end of the sensorimotor period and the onset of symbolic or representational thought is the reference point for defining developmental dimensions. In practical terms, we might say that the dimensions for each domain are defined in terms of the well-developed skills of a competent, normally developing two year old. This concept of qualitative developmental dimensions where no underlying continuous variable can be hypothesized has been borrowed from Wohlwill (1973) and is similar to the task domains Fischer (1977) has defined. In the object domain, Piaget (1951, 1952, 1954) has already delineated conceptual dimensions that a competent two year old has mastered, including the concept of object permanence, understanding of means-ends relationships, knowledge of cause-effect relationships, spatial relationships among objects, and the functional and socially influenced use of objects. Uzgiris and Hunt (1975) have constructed a set of scales to tap various points in the development of these dimensions. Our own research makes use of Uzgiris and Hunt's assessment instrument, with a few modifications, to evaluate child interactions in the object domain, and as a reference point for our own communication scale construction.

In the person-oriented domain, we are in less charted territory, but a wealth of recently accumulating information and theoretical speculation on maternal-infant interaction, the emergence of communication skills, and prerequisites to language (to be discussed later) has directed us in the delineation of component social-communication dimensions. These dimensions will be discussed specifically in the context of the assessment instrument.

The third assumption of the model, related to the structural assumption, is that development in the cognitive domains can be usefully conceived of as passing through a serious of qualitatively different stages that reflect broad changes in the structural organization that underlies the child's observed adaptive behavior (or behavior that has resulted from effective earlier adaptations). In other words, the child's general mode of interacting and problem-solving with both persons and objects undergoes major qualitative changes during these two years. Five stages or levels, as opposed to the six sensorimotor stages outlined by Piaget, are posited to encompass this developmental span, based on the theoretical and empirical work of Uzgiris (1973, 1976), McCall, Eichorn, & Hogarty (1977) and Fischer (1977). The converging evidence in support of these five levels, admittedly open to methodological criticism, is nevertheless suggestive. It is, however, too complex to address within the scope of this paper. The particular type of stage model that is being proposed is a variant of the Model IV Stage approach described by Wohlwill (1973), in which unsystematic asynchrony in development across the developmental dimensions of the object and person domains is the rule rather than the exception. This simply means that, while same-level developments along the different dimensions are, with some probability, likely to occur around the same time, no prediction is in general made about order of emergence of these new skills; a child may display skills at different levels (within limits) at any given point in time. As Wohlwill (1973) remarks, this is the most complex stage model and the most difficult to validate but, if a stage model has any validity at all, this conception

probably most closely approximates psychological reality.

The fourth assumption of the model is that the child's opportunity for experience with the sequence of skills indexing each of the developmental dimensions affects his relative level of functioning along each dimension. One qualification needs to be added to this statement on the role of experience: an upper limit in level of functioning, at any given point in time, beyond which opportunity for experience will make no difference, is probably imposed by the child's level of neurological organization, reflecting physiological factors and maturation.

III. The Assessment Instrument

Having briefly outlined the major assumptions of our theoretical model, we turn to a brief description of the social-communication assessment instrument being developed by our project. Consistent with the theoretical model, the assessment profile, which summarizes the information contained in the assessment instrument, has a vertical organization, corresponding to the developmental dimensions which are each reflected in an individual scale, and a horizontal organization, reflecting the five structural levels.

The Vertical Organization

The vertical organization of the instrument into scales reflecting developmental dimensions has been oriented around a delineation of the adaptive social-communicative problems confronting the pre-linguistic child and the concepts and skills to cope with these problems that the literature suggest are present in the normal young child around twenty-four months of age. At this age, the typical child has a very practical communication

system which is transitional into a language system which will move his communication to a symbolic or representational level. Stated another way, the scales are organized to analyze the development of social knowledge and problem-solving to the highest level of sensorimotor-social intelligence, just prior to language, much as the Uzgiris-Hunt scales trace the development of the Piagetian concepts about objects that reach their fruition at the end of the sensorimotor period.

To put this conceptualization of the processes represented by the communication scales into more practical terms for the interventionist, consider one of the criteria that has been suggested as a prerequisite when deciding whether to place a severely physically handicappd individual on an alternative communication system such as a communication board. The child should demonstrate, it is suggested, "the desire to communicate" (Harris-Vanderheiden, 1976). Our scales represent an attempt to operationalize the "desire to communicate" by breaking it down into its component processes and tracing back their origins to the very earliest level of social awareness right after birth. The questions the scales seek to provide information on then are what must the child first know before it is appropriate to consider teaching him a language system and how does he acquire that knowledge.

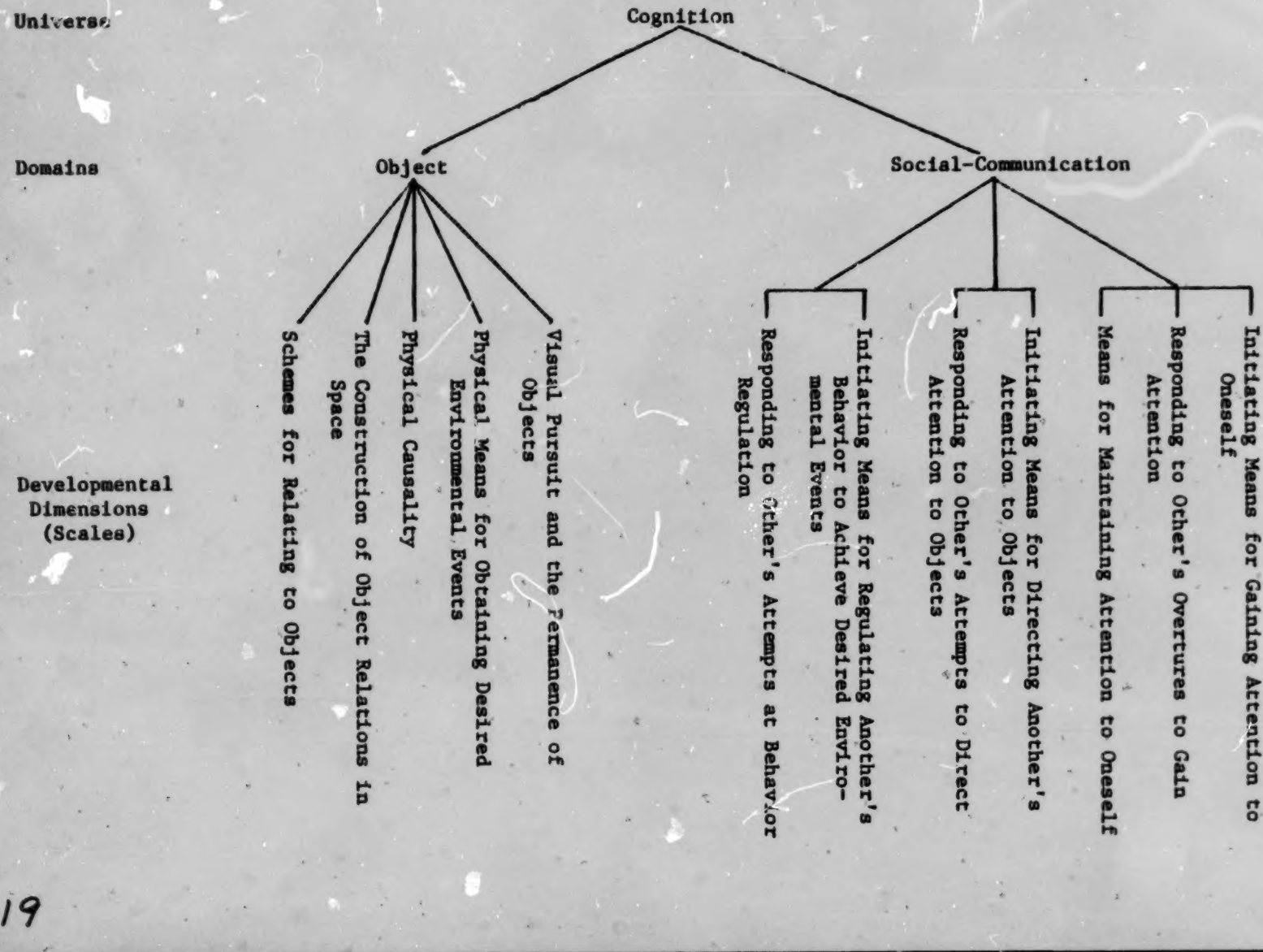
In drawing the somewhat arbitrary boundaries for the developmental dimensions in the construction of the assessment, we need first to look at the universe from which these processes are derived. As noted earlier, the model proposes that Cognition can be divided into an Object domain, which encompasses problem-solving interactions focused on objects, and a Social-Communication domain, which encompasses problem-solving interactions

focused on people (See Figure 1). This does not mean that the two domains

Insert Figure 1 about here

do not intersect or that they are mutually exclusive, but only that most behaviors can be categorized according to the primary focus of the interaction. Major developmental dimensions of the object domain, described by Piaget, are represented in the Uzgiris-Hunt (1975) scales. These object scales have been adapted for our research purposes to exclude items focused on people, which include their Imitation scales and some items from their Operational Causality scale that involve appeals to others. The social-communication scales (the vertical organization), which represent dimensions analogous to the object-related dimensions such as object permanence, are directed at three major problems that the developing child would appear to have to master before he is skilled enough in social and communicative interactions to be ready to acquire a rule-governed language system: Gaining Attention to Oneself, Directing Attention to an Object, and Regulating Another's Behavior to Achieve a Desired Goal. However, because these dimensions tap interactions with another social being, with the possibility therefore of reciprocal interactive relationships, an individual may be in either the role of the initiator or the role of responder. These dual roles involve related but nevertheless different sets of skills. This reciprocal potential is reflected in the breakdown of each social-communicative problem into the complementary dimensions of Initiating and Responding, with an additional dimension, Maintaining, included within Gaining Attention to Oneself, because it appears to develop out of an integration of both

Figure 1: Organization of the Object and Social-Communication Domains


Universe
Cognition
Domains
Object
Social-Communication
Developmental Dimensions (Scales)
Schemes for Relating to Objects
The Construction of Object Relations in Space
Physical Causality
Physical Means for Obtaining Desired Environmental Events
Visual Pursuit and the Permanence of Objects
Responding to Other's Attempts at Behavior Regulation
Initiating Means for Regulating Another's Behavior to Achieve Desired Environmental Events
Responding to Other's Attempts to Direct Attention to Objects
Initiating Means for Directing Another's Attention to Objects
Means for Maintaining Attention to Oneself
Responding to Other's Overtures to Gain Attention
Initiating Means for Gaining Attention to Oneself

Initiating and Responding and reflects a developmental skill that may be important in its own right. A schema for the breakdown of the two domains into developmental dimensions, each of which provides the conceptual basis for an individual scale, is also presented in Figure 1.

The first dimension, Gaining Attention to Oneself, encompasses those skills the child employs when no apparent goal exists external to the social interaction itself, that is, when the interaction, with attention to or acknowledgement of oneself, is the only goal of the interaction.

The second major social dimension, Directing Attention to an Object, involves the ability to share one's attention with another person beyond the immediate social interaction with each other in order to encompass an object initially external to the interaction. In other words, it involves the ability to expand attention beyond the dyadic interaction to an object outside of it, while still maintaining awareness of the social interaction.

The third major social dimension, Regulating Another's Behavior to Achieve a Desired Goal is distinct from the process involved in establishing attention to self in that there is a goal to be achieved beyond just attention to self and social interaction.

Language can be used to achieve all of these functions but skills in these areas emerge prior to the development of language. It should be noted that we do not perceive the vertical organization just described to be the only way that the social-communication domain may be sub-divided. This organization is only one among several ways of conceptualizing the component social problem-solving dimensions that can be distinguished but are nevertheless interrelated. This interrelatedness of dimensions

will lead occasionally to the assignment of a behavioral skill to one scale when a reasonable case might be made that the skill is also part of another developmental dimension. However, for the purposes of analyses involved in model validation, it is necessary to assign each item to only a single scale to prevent artifactually inflating correspondences in scores across scales. Our primary objective has been to construct an organized assessment that provides one very practical way of conceptualizing, analyzing, and assessing the different skills that together make the child an effective communicator.

The seven component processes that have resulted from our conceptual analysis have formed the basis for construction of the assessment's individual scales. In the interest of constructing developmental scales (sequences of items) that are likely to be ordinal and that do not vary widely in their task stimuli, in some cases, the developmental dimensions have been further differentiated into distinct sub-scales. Whether the different sub-scales, which can be viewed as alternative ways of evaluating the same underlying dimension, will be included in the final instrument will depend on practical concerns such as the ease with which representative behaviors can be elicited, usefulness of the behaviors in describing the child's communicative competencies, and the potential of items both as training objectives and as index behaviors of level of functioning. The specific item content of the scales is organized according to developmental levels to be discused later. The organization of the items into developmental dimensions represents our project's synthesis of an extensive research literature review.

Influencing the content and organization of the scales within Gaining Attention to Oneself is the work of Bruner (1975a, 1975b; 1977) on turn-taking, including object exchange games; the writings of Bates and her colleagues (Bates, Camaioni, & Volterra, 1975; Bates, Benigni, Bretherton, Camaioni, & Volterra, 1977) on the social attention-eliciting function of showing and giving; items from the Operational Causality scales of Uzgiris and Hunt (1975) that involve appeals for repetition of games that entail physical interaction between the child and the adult and for repetition of spectacles that the adult produces with face and hands; Brazelton, Koslowski, & Main (1974) and Trevarthen (1979) on the very young infant's early social responsivity; and the writings of Bowlby (1969) and Ainsworth (1969, 1972) on the development of social signals such as smiling and vocalizing and the various developing means for obtaining attention, proximity, and physical contact.

In the development of the scales for Directing Attention to an Object, the insights of Bruner and his collegues (Scaife & Bruner, 1975, Bruner, 1975a, 1975b; Ninio & Bruner, 1978) have been especially influential in emphasizing the social nature of the development of reference to objects and in linking shared attention to the emergence of labels for objects. Using an object label as a means for establishing shared attention to a common object is simply a less context-bound means than pointing with index finger or direction of gaze to establish that shared attention, but it accomplishes the same communicative function. Bruner, (1975a, 1975b), however, may have been mistaken in his estimation of how early - as early as four months, he asserts - the ability to follow another's line of regard, (that is, to look where someone else is

looking simply because that person is looking in that direction) emerges. The work of Collis (1977) has helped clarify its probable time of emergence at around 9-11 months. This is consistent with our own data (Seibert, 1979) that suggest that following another's line of regard is an immediate developmental prerequisite to the development of receptive labels for objects. Bates (Bates, Camaioni & Volterra, 1977; Bates, Bretherton, Shore & Carpen, 1979), drawing from Werner & Kaplan (1963), has been persausive in arguing for the significance of non-social as well as social pointing in the development of reference. Other investigators (see, for example, Huttenlocher, 1973; Nelson, 1974; Reich, 1976) have also provided important details to guide us in describing the emergence of this developmental dimenison.

In the development of the scales for Regulating Another's Behavior to Achieve a Desired Goal, the early work of Bates and her colleagues (Bates et al, 1975; Bates et al, 1977), has been most influential in analyzing the child's use of adults as social intermediaries or agents; Uzgiris & Hunt (1975), in their Operational Causality scales, have described how the child might attempt to use the adult to activate objects that he himself cannot successfully manipulate. In addition, Bruner (Bruner, Roy, & Ratner, 1979) has recently analyzed the emergence of the request function with observations that are quite consistent with our own breakdown both of the sub-scales of this developmental dimension and of the observed developmental sequences.

Nelson (1973), Benedict (1979), and Miller, Chapman, Branston & Riechle (1978) have proposed categories for the analysis of action comprehension and following simple commands that have influenced the

development of the Responding scale for this dimension. In addition, Macnamara (1977) has discussed the role of gestures and context in fostering the development of comprehension of these social signals.

This acknowledgement of the literature drawn upon in conceptualizing and constructing our set of social-communication scales is by no means exhaustive, but it does include those theorists and researchers whose ideas have been most seminal to our own efforts.

The Horizontal Organization

With this sense of vertical developmental dimensions in mind, conceptualized as general problem-solving skills with people, we are now ready to look at the horizontal organization of the scales, that is, at the series of developmental levels, each organized by a common structural base, that cut across the vertical developmental dimensions. Our approach is not unique but represents a synthesis of the ideas of a number of other theorists and investigators who have embraced a stage model of development and have sought to determine what common cognitive structures might underlie skills and competencies in both the object and social domains.

The theory and research from which this stage or level assumption of the model has been derived include the writings of Uzgiris (1973, 1976); McCall, Eichorn, & Hogarty, (1977); Fischer, (Fischer, 1977, Fischer & Corrigan, 1979); and Bates and her colleagues (Bates et al, 1975; Bates et al, 1977; Bates et al, 1979). All of these investigators have operated within a Piagetian, or neo-Piagetian, framework in attempting to evaluate the evidence for structural correspondence across domains. The kind of

stage model that appears to be emerging, based on available data, is one in which neither the object domain nor the social-communication domain is considered more basic than the other. Congruence in development across domains is attributable to development along common structural lines. Structure, in other words, is a basic aspect of the organization of behavior that can manifest itself through development in either domain. Decalage or discrepancy in level of development across developmental dimensions is observed due to variability in the nature of the individual's motivation and opportunity for experience along each dimension. Development in neither domain is prerequisite to development in the other domain, except when a skill in one domain is a component of a skill in the other domain.

The structural stage model, proposed to describe the qualitative shifts in organization of behaviors in both the object and the social-communication domains across the first eighteen to twenty-four months of life, posits a series of five successive, qualitatively different structural levels during this developmental age span. These five levels, synthesized from research literature noted, can be characterized in the following ways:

Level 0, spanning approximately the first one to two months, has been previously characterized as reflexive (Fischer, 1977; Seibert, 1979). In light of recent evidence for the greater perceptual sophistication of the neonate and tentative evidence for cortical control of visual processing, manifested in visual recognition memory (Fagan, personal communication), the appropriate characterization for this initial level,

however, may be responsive, rather than reflexive. Responsive, in this sense, can then be contrasted with initiating.

Level 1, spanning approximately two to seven months, has been characterized as the level of simple, voluntary action. Intention becomes evident in the infant's behavior through repetition of simple acts that produce consequences of interest to the infant. There is, however, no differentiation of means from ends, since goal-directed behavior (e.g., reaching and grasping an object) can be frustrated by an obstacle, which to be circumvented would require subordination of a second action (removing the obstacle) to the goal-directed act (reaching and grasping).

At Level 2, approximately 8 to 13 months, this coordination of action sequences in service of a goal becomes possible as means become differentiated from ends and the child's actions begin to reflect a perception of physical differences among the objects and persons in his environment. However, the means-ends relationships employed to reach goals operate as undifferentiated wholes and the child appears to act with no real understanding of the relationships involved.

At level 3, spanning 13 to 18 months, the child's problem-solving demonstrates an understanding of the means-ends relationships he employs, as he becomes capable of discriminating when a particular means is appropriate to a goal and of modifying his actions when feedback indicates that his efforts are unsuccessful. It is at this level that object and social skills may be integrated and the highest level of non-representational problem-solving is observed.

At Level 4, covering 18 months and on, the child moves to a representational mode of problem-solving, beyond the sensorimotor level. The child begins to anticipate which means are most appropriate in relatively novel problem-solving situations, and incorporates behaviors that rely on symbolic skills into his problem-solving endeavors.

This brief characterization of the levels is clearly quite general, but it should be apparent how it could be used to characterize a child's problem-solving interactions with people as well as with objects.

Each of the Uzgiris-Hunt scales, as well as the set of social-communication scales, has been organized according to these levels, with at least one item (called a criterial item) selected or developed for each scale at each level. As previously noted, a modification of the Uzgiris-Hunt (1975) scales was made for our own research purposes to remove all items that require social responses to the tester from the object scales and incorporate them into the social-communication scales. The end products are two sets of scales, designed to assess two cognitive domains, relatively indepedently defined. One set of scales is designed to assess dimensions of the domain of the child's interactions with and use of objects; the second set of scales is designed to assess dimensions of the domain of the child's interactions with and use of people. Both sets of scales (summarized in profiles) are organized horizontally according to the series of hypothesized common or shared levels of structural organization. Table 1 shows the results of the process of level assignment applied to a scale from each domain.

Insert Table 1 about here

Table 1: Examples of Scales from the Object Domain and the Social-Communication Domain, Organized According to the Five Structural Levels

	Object Domain: Schemes for Relating to Objects	Social-Communication Domain: Initiating Social Means to Achieve Desired Environmental Events (Obtaining Desired Object)
0 (1-2 mos.) Responsive Interaction	Holds or grasps object placed in hand	Cries or fusses with no apparent environmental cause
1 (2-7 mos.) Simple Voluntary Action	Uses only simple action patterns on all objects (e.g., mouthing, banging, waving)	Cries or fusses when object is moved out of reach
2 (8-13 mos.) Differentiated Action	Uses different actions for different objects (e.g., stretches elastic, rubs cotton)	Either looks to other or exhibits sustained reach to desired object out of reach
3 (13-18 mos.) Action Modified by Differentiated Feedback	Uses objects in socially influenced ways (e.g., combs hair, wears necklace)	a. Reaches or points to object out of reach and looks to other b. Directs single word request to other for object out of reach
4 (18 mos. +) Action Modified through Anticipatory Regulation	Uses objects in representational play (e.g., feeds doll, combs doll's hair)	Requests object out of view

While a discussion of how the defining criteria for each of the levels were used to assign items by scales in both domains to each of the levels is beyond the scope of this paper, it is hoped that the brief characterization of the major organizational aspects of each level may provide some general appreciation of the process involved. It should be noted that structural criteria, rather than the developmental age estimates that were available for some items, directed decisions of level assignment.

IV. Research to Validate the Model

Given the relatively complex nature of the theoretical model, which attempts to organize a considerable amount of behavior into one comprehensive framework, one may reasonably ask where to begin in any attempt to validate the model, or, perhaps more basically, what would constitute evidence in support of the model. The nature of the structural correspondence hypothesized between the object and the social-communication domains is general rather than specific, and neither domain is considered to be more basic than the other. Therefore, predictions about the order of emergence of skills cutting across domains, or predictions about relative onset times for structurally similar items, except within broad limits, do not fall out of the model.

It may be informative first to compare our approach to that of Bates and her colleagues (Bates et al, 1977; Bates et al, 1979), who are asking fundamentally similar questions but at a more specific level of analysis. Bates and her collaborators have been looking for very specific structural relationships between specific sets of skills in the communication domain and specific sets of skills in the object domain, at the same developmental

level. They hypothesize that, where consistent patterns of high correlations are observed between sets of skills, a high degree of structural relationship between the skills probably exists. For example, in their research, use of communicative gestures directed to others to achieve ends correlates with object-related means-ends measures, but generally not with object permanence skills, in a sample of normal 9 to 13 month olds. Therefore, Bates argues that using adults as intermediaries and using objects as intermediaries are manifestations of a specific common cognitive structure that is not related to object permanence skills at this developmental level.

Our question is a much broader one, however, but not incompatible with Bates' specific concerns. We are attempting to determine first whether it can be established, at a global level, that a series of very general shared organizational structures underlie developments in both the object and the social domains, which are reflected in a series of changing adaptive strategies for interaction with both environments. Bates (1980) has criticized attempts to establish such global structural correspondences as neither informative nor particularly interesting in elaborating the relationship between language and cognition, but a discussion of her criticism will be reserved for the final section of this paper.

We believe that the correlational approach represented by Bates' work is equally appropriate to the broader question that we are asking; however, some fundamental issues must be addressed, when using such a correlational approach, if we are to provide evidence for a cognitive structural base underlying both domains rather than for a correspondence that is a result of a broader and less interesting developmental function.

Within a normal population sampled to represent such a broad (two year) developmental age span, it may be expected that developmental measures of social-communication and object cognition will be highly correlated with each other. However, such a correlation would hardly constitute evidence for a specific cognitive structural relationship between the two domains, since these developments are also highly correlated with other non-cognitive measures such as physical age (an index of general physical maturational level) and chronological age (an index of opportunity for experience). Therefore, any correlational attempt to validate such a general model on a normal population is probably doomed to inconclusiveness at best. What is needed is a population where all of these measures are less likely to be confounded with each other, where, if the model is valid, the only correlational relationship that should consistently hold up across samples is the one between the social-communication and object cognition measures.

The basic rationale for this approach is that if a sample representing this broad developmental span can be constituted such that correlations between some measures are reduced substantially, it may be concluded that the nature of the relationship between such measures observed in normal development is not a necessary one. Where strong relationships maintain between measures, the case for specific common structural relationship is strengthened. A heterogeneous handicapped population could provide an appropriate natural experiment for such a test of the model's predictions. With a mix of young children having a variety of physical and sensory handicaps and representing a broad range of degree of retardation from

mild to severe, it may be expected that neither chronological age nor physical age will be particularly predictive of mental age within the group. If a strong relationship nevertheless is observed between communication and object cognition measures in such a sample (assuming behavioral items designed to assess level of development in each domain do not overlap), the case for a common cognitive structural base underlying the two domains will have been supported. This in fact is the approach that we have adopted in the research to be reported. The point made earlier, that the research project represents the reciprocal interplay between the theoretical and the applied, is reinforced: the population most likely to benefit from a validation of the model represents the most appropriate population for a test of several predictions of the model.

It should be noted that this research strategy is at odds with what is the more common design in research on handicapped populations. Kopp and Krakow (1980), for example, recently argued for more careful specification of sample characteristics, with greater effort directed at sample restriction and sub-categorization. However, such dichotomies in design are by no means irreconcilable; rather, they are a reflection of different research questions as we commented upon earlier. Our initial research goal is aimed at uncovering universal aspects of development, independent of disability. Research such as that reviewed by Kopp and Krakow (1980) seeks to demonstrate individual differences (which we certainly acknowledge exist) in patterns of development across different well-defined subsets of high-risk and handicapped groups, to evaluate how the type of disability interacts with developmental progress in the various

domains. Our theoretical model assumes such individual differences to be the rule, and future research will be directed at an understanding of such individual differences within the framework of the model. But, to reiterate, our current research question is directed at issues of universality, and a heterogeneous sample becomes an asset rather than a liability when asking such a question. Ultimately, we believe it will be of value to understand the similarities among the different disability groups to provide a perspective for evaluating group and individual differences.

In summary, the questions to be addressed in our research are: Can evidence be provided for a common structural base underlying both the object and social-communication domains, relatively independent of both chronological age and physical age, and can evidence be provided that levels across domains have been equated structurally?

Method

Subjects: A sample of handicapped infants and toddlers, accessible through their participation in a daily center-based program of early intervention, provided the subjects for the research to be reported. There are more children in the intervention project than were included in this study, but several criteria were used to exclude certain subjects from the sample prior to any analyses.

Criteria for inclusion in the study were that the child have enough functional vision and motor ability to demonstrate reach and grasp and that Bayley Scale scores place him more than two standard deviations below the norm in either mental or motor performance. The data to be reported are from 39 children, ranging in chronological age (corrected) from

8 months to 42 months, with a mean age of 27.9 months and a standard deviation of 9.2 months, and ranging in mental age from 4 months to 27 months, with a mean mental age of 13.8 months and a standard deviation of 5.7 months. Eighteen of the children are males. A variety of handicapping conditions are represented in this sample, ranging in severity from mild to severe, with disabilities including Down's Syndrome, hydrocephaly, microcephaly, cerebal palsy, hearing impairment, visual impairment, and emotional disturbance, and various combinations of these disabilities. The vast majority of these children are from low SES families, reflecting the eligibility criteria of the state funding agency.

Procedures: The basic procedures for the study to be reported included the assessment of each project child, with the total testing period for each child spanning no more than three weeks, on both the object scales and the social-communication scales, as well as on the Bayley Motor and Mental Scales. Except for some minor modifications, details of the procedures for administration of the object scales can be found in the published book by Uzgiris & Hunt (1975). As noted earlier, some of their scale items with a primarily social emphasis have been removed from these scales. This has been done to insure independence of item content between domains so that any observed correspondences are not artifactually inflated by item overlap. Written procedures for the social-communication assessment instrument are being developed but are not currently available for dissemination.

The data for each child include corrected chronological age, Bayley MA and PA, and two mean level scores, one for the object scales and one

for the social-communication scales. The mean level scores were computed in the following way. For each scale administered from each assessment domain, a prototypical or criterial item had been established for each of the five levels. The highest level criterial item a child passed in each scale was the score the child received for that scale. So, for example, if a child passed the criterial item at level 3 in the Directing Another's Attention to an Object scale, a score of 3 would be given to the child for that scale. A mean score can then be determined for each child in each of the two domains by computing the average level score across the scales for each assessment domain. In the object domain, this average was based on five Uzgiris-Hunt scales (with the imitation scales excluded). In the social-communication domain, Responding to Other's Attempts to Gain Attention and Maintaining Social Attention/Interaction were excluded from the analyses because criterial items were missing from the scales when they were originally administered and data were incomplete for these scales on a large number of subjects. In addition, scores for two sub-scales (To Obtain Objects and To Obtain Interesting Events) of the Regulating Another's Behavior scale were computed separately and each was included in the computation of the average level score for the social-communication domain. Therefore, five separate scale scores were used to compute the mean object level score for each child and six separate scale scores were used to compute the mean social-communication level score for each child.

Communication scale testing and object scale testing for each child were carried out independently and rated without knowledge of performance

in the other domain by different research assistants. Six different testers were involved in the assessments. Only one tester was trained on both sets of scales, but she never administered both assessment instruments to the same subject. All testing sessions for both sets of scales were videotaped and independently scored by two raters. The ongoing availability of the project children for testing assured that the testers could be familiar adults to each child for the social-communication testing and that rater disagreements in level assignment for any scale, when they occurred, could be resolved by direct access to the children, which should have considerably reduced measurement error.

Inter-rater reliability for each scale was computed by dividing the total number of agreements in level assignment by the total number of children in the sample. Inter-rater reliability on level assignment for each scale across both domains ranged from 85 to 100%, with most agreement levels above .90.

Results

To address the question of shared structure across domains, several analyses were conducted on the data. First, a series of pairwise Pearson product-moment correlations was carried out on all the measures gathered on each child for the total sample of 39 children to examine the pattern of relationships among the variables. In addition, a hierarchical multiple regression/correlational analysis (Cohen & Cohen, 1975) was conducted to determine the proportion of the total variance in the communication scores shared with the object scores, with the variance attributable to both physical and chronological age removed from the communication scores.

Table 2 summarizes the means and standard deviations for the sample across all of the dependent measures. The results of the series of pair-wise correlations on the data are presented in Table 3.

Insert Tables 2 and 3 about here

Chronological age, as anticipated with this sample, is only modestly correlated with both the object measures and the social communication measures. What is more important to the prediction of the model is the low correlation of physical age with communication level (.47), coupled with the very strong relationship (.85) between object scores and social-communication scores. The multiple regression/correlation analysis performed to determine the strength of the relationship between the object and communication scores, with the variance attributable to physical age and chronological age removed from the communication scores, reveals that the object scores share 53 per cent of the variance with the communication scores. Table 4 presents the details of this analysis. The

Insert Table 4 about here

fact that communication relates strongly to object cognition level but not to physical age provides strong support for the model's assertion that developments in the object and communication domains are related in a structural way that is distinct from a more general developmental function, reflected in motor development, or opportunity for experience, reflected in chronological age.

Despite the support the data provide for a structural relationship

Table 2

Means and Standard Deviations for Measures on Total Sample (N=39)

Measure	Mean	Standard Deviation
Chronological Age (mos.)	27.92	9.20
Bayley Mental Age	13.85	5.65
Bayley Physical Age	14.50	6.96
Mean Communication	2.38	0.81
Mean Object	2.46	0.92

Table 3

Correlations among Chronological Age, Mental Age, Physical Age, and Mean Social-Communication and Object Cognition Scores for Total Sample (N=39)

	CA	MA	PA	Mean Comm.
MA	.57***			
PA	.68***	.73***		
Mean Comm.	.38*	.83***	.47**	
Mean Object	.62***	.90***	.70***	.85***

* $p < .05$

** $p < .01$

*** $p < .001$

Table 4

Results of Multiple Regression/Correlation Analysis to Determine Relationship Between Object Scores and Communication Scores, with Variance Attributable to Physical Age and Chronological Age Removed from Communication Scores for Total Sample (N=39)

Variable	R^2	R^2 Change
PA	.22	.22
CA	.23	.01
Mean Object	.76	.53

between the communication and object domains, a summary descriptive analysis at the individual case level is needed to determine whether object and communication levels have been appropriately equated for structural congruence.

A related question that can be answered with the data is whether the developments in one domain consistently lead developments in the other or, as the model predicts, whether the relationship is variable from individual to individual, as a function perhaps of differential motivation and opportunities for experience in each domain, with some children showing communication skills more advanced than their object skills, and others displaying the opposite pattern. To answer this question, the difference in each child's mean communication level score relative to his mean object level score was computed. Perfect level correspondence between the two domains for all children, as just noted, is not a prediction of the model. The model predicts that, given a large enough sample, the discrepancies between performance levels in the two domains for each child should distribute themselves symmetrically around the zero point. In addition, a mode within a narrow range around zero, while not critical to the model, (since, depending on individual experience, either domain could lead) would lend strong credence to the hypothesized level congruence across domains. The results of the test of this prediction are presented in the frequency histogram in Figure 2,

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Insert Figure 2 about here

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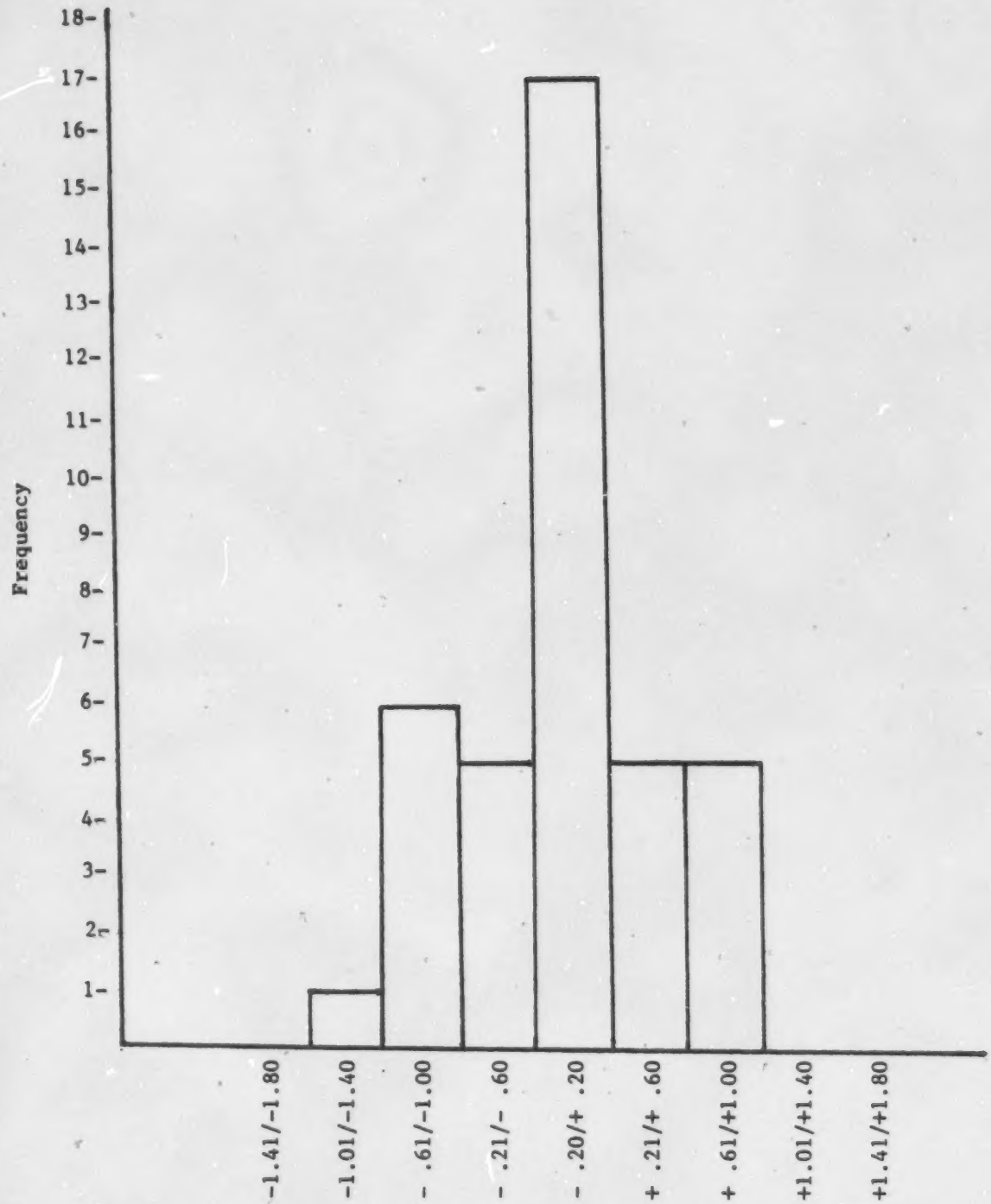
for the differences in mean levels, with mean object cognition level as

Figure 2: Frequencies of Discrepancies Between Mean Communication and Object Levels in .4 Stage Intervals (n=39)



Differences in Overall Mean Communication Level Relative to Overall Mean Object Cognition Level in .4 Stage Intervals

the anchor point. The distribution of differences is as predicted. Frequencies to the right of the zero point represent those children with mean communication levels higher than object cognition levels; to the left of zero are those with mean communication scores lower than their object cognition scores. The modal cluster of differences around zero and the roughly equal distribution of scores on both sides of the zero point (12 vs. 10) argue very strongly for the structural equivalence of the levels in the two domains. If developments in one domain typically lead developments in the other domain, a shift in the peak away from the zero point should have been observed, to the right if social-communication typically leads development, and to the left if object cognition typically leads. An inspection of the mean level discrepancy scores in both directions indicates that discrepancies of various magnitudes are distributed evenly across all levels. Thus, there is no evidence that the results are an artifact of ceiling or floor effects. Correspondence in levels is no more likely to be observed at either the highest or the lowest levels. It should also be noted that this observed pattern could not simply be an artifact resulting from the scoring criteria producing flat profiles (that is, profiles for individual children where scores are all at the same level), because such profiles were very much the exception to the typical profile patterns observed. Recall also that data were gathered by testers/raters independently for each domain.

In the interest of pushing the predictions of the model even further, we considered whether any criteria might be set forth for partitioning this sample into a subsample where the relationship of the various

measures with chronological age, and perhaps with physical age, could be reduced still further, in order to observe what effect this has on the nature of the relationship between social-communication scores and object scores. In order to control for opportunity for experience, and to construct a sample that, if developing normally, should have mastered all of the items represented on both assessment instruments, it was decided to perform the same analyses, just reported on the total sample, on a subgroup that included only those children above 30 months of age chronologically. Using these criteria yielded a sample of 21 children, ranging in age from 30 months to 42 months, with a mean age of 35.0 months and a standard deviation of 3.0 months. This group ranged in mental age from 6 months to 27 months, with a mean mental age of 15.9 months and a standard deviation of 5.8 months. A similar variety of handicapping conditions as existed in the total sample is represented in this subsample.

Table 5 summarizes the means and standard deviations for this subsample across all of the dependent measures. The results of the series of pairwise correlations are presented in Table 6.

Insert Tables 5 and 6 about here

The relationship of chronological age to the other variables has been further reduced, as had been anticipated in constructing this subsample. The correlations of physical age with both the object and social-communication measures has likewise been reduced, to a non-significant level in the case

Table 5

Means and Standard Deviations for Measures for Subset of Total Sample with Chronological Age Above 30 Months (N=21)

Measure	Mean	Standard Deviation
CA	35.00	2.98
MA	15.90	5.76
PA	17.71	6.99
Mean Communication	2.58	0.82
Mean Object	2.87	0.92

Table 6

Correlations among Chronological Age, Mental Age, Physical Age, and Means for Communication and Object Scores for Sub-sample Above 30 Months of Age (N=21)

	CA	MA	PA	Mean Comm.
MA	.40*			
PA	.58**	.65***		
Mean Comm.	.09ns	.79***	.29ns	
Mean Object	.38*	.88***	.56**	.88***

* $p < .05$

** $p < .01$

*** $p < .001$

of the social-communication measures, which also had been anticipated as a possible outcome. What is most significant to the prediction of the model is that the relationship between the object and the social-communication measures (.88) remains virtually unchanged in this sub-group, despite the changing pattern of correlations with chronological age and physical age. When the multiple regression/correlation analysis is performed on this sub-set of the data, with the variance attributable to physical and chronological age removed from the communication scores, the results are even more dramatic. For this sub-sample object scores share 76% of the variance with communication scores. The results of this analysis are presented in Table 7.

Insert Table 7 about here

To push the model and the assumptions behind our research design to the extreme, for a final set of analyses, we set out deliberately to constitute a sub-sample from the total sample where physical age would bear no relationship, or perhaps even a negative one, with communication level. To construct this sample, we established a criterion for inclusion of at least a four month discrepancy for a child between his Bayley mental age and physical age. Employing such a criterion yielded a sample size of 13 from the original 39 children. This sample ranged in age from 20 months to 42 months, with a mean age of 32.7 months and a standard deviation of 6.5 months. Mental ages ranged from 4 months to 24 months, with a mean of 16.5 months and a standard deviation of 4.8 months.

Table 7

Results of Multiple Regression/Correlation Analysis to Determine Variance Shared between Object Scores and Communication Scores, with the Variance attributable to PA and CA removed from Communication Scores, for Subset of Sample where CA is greater than 30 Months (N=21)

Variable	R^2	R^2 Change
PA	.09	.09
CA	.09	.00
Mean Object	.85	.76

Table 8 summarizes the means and standard deviations for this sub-sample across all dependent measures. The results of the series of pair-wise correlations are presented in Table 9. Our criterion succeeded

Insert Tables 8 and 9 about here

in constituting the desired sample; chronological and physical age correlate significantly with each other in this sub-sample, but neither correlates significantly with any of the other measures. In fact, the directions of the correlations of CA and PA with communication, although not significant, are both negative. However, what is again critical to the predictions of the model is that the correlation between object and social-communication measures again remains virtually unchanged (.84). When the multiple regression/correlation analysis is performed on this sub-set of the data, with the variance attributable to physical and chronological age removed from the communication scores, the proportion of the variance in the communication scores shared with the object scores rises to 80 per cent. Table 10 presents the results of this regression analysis.

Insert Table 10 about here

These three sets of analyses, performed on the total sample and on two specifically defined subsets of the total sample, one for which the effect of opportunity for experience is controlled for and one for which the discrepancy between physical age and mental age is exaggerated, provide

Table 8

Means and Standard Deviations for Measures for Subset of Total Sample Where Bayley Mental Age and Physical Age Are At Least 4 months Discrepant (N=13)

Measure	Mean	Standard Deviation
CA	32.69	6.46
MA	16.46	4.81
PA	18.38	7.62
Mean Communication	2.62	0.83
Mean Object	2.97	0.62

Table 9

Correlations among Chronological Age, Mental Age, Physical Age, and Means for Communication and Object Scores for Sub-sample where MA and PA are at least 4 months Discrepant (N=21)

	CA	MA	PA	Mean Comm.
MA	$-.054^{ns}$			
PA	.54*	$.23^{ns}$		
Mean Comm.	$-.30^{ns}$	.82***	$-.07^{ns}$	
Mean Object	$.15^{ns}$	.83***	$.23^{ns}$	.84***

* $p < .05$

** $p < .01$

*** $p < .001$

Table 10

Results of Multiple Regression/Correlation Analysis to Determine Variance Shared between Object Scores and Communication Scores, with the Variance Attributable to PA and CA Removed from Communication Scores, for Sub-sample where MA and PA are at Least 4 Months Discrepant (N=13)

Variable	R^2	R^2 Change
PA	.01	.01
CA	.10	.09
Mean Object	.90	.80

impressive support for the model's predictions. A strong case has been built for the claim that developments in the social-communication and object domains during the first two years of life share a common structural base that is specific to changing cognitive modes of adaptive environmental interactions, and is not simply a reflection of a broad developmental function.

V. Discussion and Conclusions:

Methodological Issues

Before concluding with a consideration of what the current data mean and what we see as the future directions of our research, we would like to anticipate a few of the methodological criticisms that can be leveled at the research to date. We recognize that our analyses have made certain assumptions about the data that remain to be validated empirically, but the decisions to do this were made quite intentionally. We felt that we needed to make those assumptions in order to begin to test certain other assumptions of the theoretical model. If the results had not confirmed our predictions, we may not have known whether the fault lay in the model or in some of the methodological assumptions. But since we may not have all of the information we need for a long time, our plan of action has been to see if a reasonable case could begin to be constructed for the model, despite the lack of data to back certain methodological assumptions. We are more concerned with whether our data can be made sense of within the context of our theoretical model than with meeting every statistical assumption necessary before a statistician would be comfortable with our analyses (see Cohen & Cohen, 1975, for an extended discussion of

this issue).

First of all, we have analyzed the data and assigned level scores assuming the scales to be ordinal, but we recognize that longitudinal data on a subset of our population (currently being collected) as well as cross-sectional data on normal children will be needed to verify this assumption. On the other hand, nothing in the pattern of results suggests that the ordinality assumption is an unreasonable one, and a logical argument for ordinality can be made for most of the scales based on the hierarchical nature of the items in the sequences.

A second less obvious assumption we have made is that, in computing level means, we treat the steps between criterial items on our scales as if they represent equal intervals. This assumption may be less likely than the ordinality assumption, but a case again can be made that it does not grossly misrepresent reality since the data make sense in light of this assumption. But to be conservative, for a subset of the data, we carried out all of the same analyses using psychometrically acceptable medians rather than means for the communication and object measures. The pattern of magnitudes of correlations with both measures were nearly identical; correl tions between means and medians in each domain equalled .97. Obviously, both measures are yielding very similar information. But there is further reason to believe that the equal interval assumption between levels is a reasonably accurate reflection of the actual state of affairs. Wohlwill (1973) has argued that, for qualitative developmental dimensions, such as those represented in our scales, where no underlying continuous quantitative dimension is posited, the developmental dimension

can only be conceived to be in a monotonic relationship with the age variable. For normally developing children, the developmental dimension then becomes equivalent to the age variable itself. Therefore, evidence of nearly equal developmental age distances between criterial items at the different levels would support the assumption that the scales are equal-interval. In fact, where age estimates do exist for criterial items represented on our scales, the intervals between levels tend to be about five to six months.

Another concern that may be raised is that, given the non-representative nature of our sample, what justification can there be for generalizing any conclusions from this study to the population at large, that is, to normal children. The rationale for this must go beyond the data itself to the assumptions behind the theoretical model and our research methods. Our research samples are obviously non-representative, but for a very definite reason. As we discussed earlier, all of the variables we are examining in this study are highly correlated with each other in the normal population across the developmental age span represented in our sample. This high degree of relationship in the normal population makes it difficult, if not impossible, to separate the effects of the different factors associated with CA and PA from the structural ones that the model asserts should produce a strong relationship specifically between communication and object scores. What is absolutely critical to confirmation of the model is that social-communication and object scores across the developmental span represented by both sets of scales remain highly correlated with each other despite changes in their respective relationship to physical age or

chronological age across samples; this is what our data demonstrate. The model would be disconfirmed only if a sample could be constituted where the communication and object measures across this developmental age span are not highly correlated with each other. Had we limited ourselves to a specific disability group, say Down's Syndrome children, rather than constituting such a heterogeneous sample, we may have been open to the criticism that the relationships we observed are specific only to the syndrome group studied. The heterogeneous nature of the sample would therefore appear to be a strength of the design that increases the generality of our findings. In future research, we intend to gather data on the degree of relationship across measures to be observed both in a sample of normally developing infants and toddlers, as a normal reference point, and in a sample of older profoundly mentally retarded children with considerably more opportunity for experience for whom terminal developmental levels are more likely to have been achieved. The latter group may help push the model to its limits.

Legitimate concern could also be raised about the issue of level assignment of items across scales in constructing our assessment instruments. Despite the concurrence among investigators (Uzgiris, 1976; McCall et al, 1977; Fischer, 1977) on the existence of these levels, discussed earlier, further effort must be directed at operationalizing the decision rules for assigning items to levels to assure an acceptable degree of reliability for this process. Developing a set of decision rules is not as straightforward as it may seem, since factors such as how a particular skill has been acquired or how context-specific it is may affect the decision about level assignment. There are, in fact, discrepancies among investigators

as to what levels some object cognitive items are assigned and, although agreements far outweigh disagreements, failure to reach eventual consensus on decision rules will compromise the value of such a structural approach. One of the directions of our own research efforts will be to specify further the decision rules for level assignment, based on some variant of the set theory model proposed by Fischer (1977).

A final concern we would like to address, before considering intervention implications of the model, is the criticism Bates (1980) has leveled against any attempt to establish such global correspondences between domains. In particular, Bates has argued that a demonstration of such a global relationship would only be an indication of a general relationship that is a function either of maturational factors or, perhaps, of g, that is, of a general factor of intelligence. Such a relationship, if demonstrated, would be uninteresting and not particularly illuminating in understanding specific cognitive factors underlying language development, according to Bates. While we agree that demonstration of such a relationship sheds little light on the specific relationships, its interest and value should not be dismissed so lightly. As for Bates' first alternative, we believe our data demonstrate that the relationship between domains is a reflection of something more specific than maturation or some general developmental function, as discussed already in some detail. Bates' alternative interpretation, that any such relationship is mediated by a general factor of intelligence, more closely represents the nature of the relationship; however, it seems to us that glossing over the nature of this relationship as simply a reflection of a general factor of intelligence misses the

point. The relationship must still be mediated by some basic cognitive structural organization, the nature of which appears to change over time. In other words, g may mediate behaviors in both domains but how it mediates behaviors changes over time, and it would be useful to understand how it changes. Demonstrating such a relationship and defining the nature of the changing organizational principles would be informative for both theoretical and practical reasons. Practically, it would suggest a basis for conceptualizing interventions across the two domains according to common principles and it would provide a very useful framework for analyzing a child's profile of strengths and weaknesses across domains. The more specific relationships that Bates and her colleagues seek to determine will likewise be useful, especially for a finer tuning of one's interventions and for a better understanding of specific structural relationships that underlie narrower sets of behaviors. But specific structural relationships must be mediated first by broader structural relationships (especially if we expect these structures to be mediated at a level of neurological organization). The detail of information available from both levels of analysis should be both interesting and informative, although perhaps for different reasons. The different types of questions being asked are reflected in the different research strategies. Bates is looking for specific relationships among specific behaviors within a narrow developmental time span. We are trying to get a broader picture of "the lay of the land" and so we sample a broader developmental span and seek evidence for more general structural principles. Neither approach is more valid or interesting, once one acknowledges the different questions that are being addressed. But each level of analysis

is essential for a complete picture of the structural relationships between domains. This might also be the appropriate place to note that we recognize that the model represents our own attempt to impose organization on a large array of behaviors. We are not arguing for the psychological reality of these structures but rather, for the heuristic value of conceptualizing the domains of behavior in this way. Clearly, analyzing a young child's communicative functioning by reference to a competent two-year old involves an abstraction that we are imposing on his behavior; such a reference point has no reality for the child.

Further research needs to be done, both to validate the assessment instrument and to provide further support for the structural model. The ordinality of the individual scales, as already noted, remains to be established through longitudinal studies of both handicapped and non-handicapped children (some of which are currently underway) and through cross-sectional studies with normal children.

Research also needs to be directed at the determination of interrelationships among skills across different scales both within and between domains. In some cases, a skill or concept in one scale may be a prerequisite to the development of a skill in another scale. The abstraction of component dimensions into separate scales should not be interpreted to mean that development along each dimension is independent and unrelated to developments within other scales. Data have already been gathered on the possible prerequisite relationship between socially appropriate use of objects and the emergence of receptive labels (Seibert, 1979). We also intend to conduct training studies to evaluate empirically hypotheses about the prerequisite nature of certain skills for others that

emerge from the longitudinal studies. In addition, training studies will be conducted to test other predictions of the theoretical model about the structural relationship across scales and domains. One strategy will be to select children at the same developmental level in one scale, who are at different levels of development on an hypothesized closely related scale, and provide training on the scale where everyone's score is matched. Terminal level performance on the trained scale for each child will then be correlated with scores on the second scale. The model predicts that a significant correlation should exist between these sets of scores, if the scales are in fact structurally related. We already have pilot data on a small number of subjects from a training study on self-recognition skills, who were matched for initial self-recognition level but were functioning at various levels on the object permanence scale. Their post-test scores on self-recognition in fact correlated moderately and significantly with initial object permanence levels, in accordance with the model's prediction.

Intervention Implications

This paper began with a consideration of the need for a comprehensive theoretical model to guide one in the implementation of an assessment-intervention approach to developmental disabilities. We suggested inadequacies with most currently available developmental assessments and argued for a different kind of instrument which could link intervention more directly to the information derived from the assessment instrument. The remainder of the paper was then devoted to a fairly detailed articulation of a theoretical framework to organize behaviors between

birth and about thirty months in the social-communication and object cognition domains, according to a general cognitive structural model. We reviewed the evidence gathered to test several predictions of the model, concluded that the cognitive structural approach was strongly supported, and then addressed several methodological criticisms that could be leveled at the research to date. In this concluding section, we will attempt to bring the discussion full circle and address some intervention implications of the model and assessment instrument that have been described in the preceding sections.

The validation of such an assessment model for the development of early communication skills should have far-reaching implications for the interventionist working with young handicapped children. First of all, the structural model provides the possibility of integrating a vast amount of behavioral data on adaptive functioning into a single, meaningful, comprehensive framework. The possibility to focus on process rather than having to rely only on empirically derived sequences of developmental milestones should provide the interventionist with a picture of the child's current functional skills and strategies, and a clearer sense of what more sophisticated functional skills he should be mastering along each developmental dimension (scale). The sequences laid out in an ordinal fashion should translate directly into training sequences, and knowledge of prerequisite skills across scales will be invaluable in making programming decisions. The focus on process should be especially valuable for the interventionist working with physically handicapped or sensory-impaired children, because the significance of a particular

behavior should lie primarily in the function and understanding about people or objects that it represents; the topography of the behavior itself should be incidental to the process.

The model's concept of structural levels, which allow items across scales to be equated for structural complexity, adds another important feature to the assessment information derivable from the scales. If this structural equivalency is reasonably demonstrated, then the developmental profile across domains that can be constructed for each child should show his relative levels of development through the various component dimensions across both the object and the social domains. An uneven profile, with lags observed in certain scales compared to others, might then indicate those areas where the child has missed opportunities for appropriate experience and where intervention efforts are initially likely to be most effective. This prediction follows from the model because the higher level scale scores are assumed to indicate the presence, at a global level, of the necessary underlying structural organization for development to the same level in the lagging scales. This concept of leading developmental dimensions is analogous to the peak performances that Feuerstein (1979) has described as indices of greater potential for change in the children assessed with his instruments.

Of course, the presence in the child's repertoire of skills that are more closely related to the deficient skill that appear to be derivable from specific common homologous structures at a particular developmental level (the kinds of structural relationships that Bates et al, 1979, have been attempting to uncover) should serve as the more

powerful predictors of potential for remediation in the more deficient skill area. The model, furthermore, suggests that the intervention strategies for a child with a flat profile (all component dimensions at the same level) should be different from the strategies for the child with the uneven profile. The goal for the child with the flat profile is not simply to bring some component skills up to the highest developmental level manifested in a domain, but rather to foster the child's overall development to a new level of functioning, involving a different mode of interacting with both his physical and his social environment. The initial strategy for the child with the uneven profile would appear to be primarily one of specific enrichment, that is, of providing opportunities for appropriate experiences, while, for the child with the flat profile, the strategy would appear to be one of generating manageable conflicts for the child that literally challenge his current conception of the world and call for him to interact in a more complex fashion. Whether we can arouse that conflict and trigger disequilibrium in the child depends then not only on our own creativity, but on intra-organismic factors, such as maturation and motivation, that could be beyond the interventionist's control.

The notion of levels organized according to structural complexity also suggests a global strategy for organizing curricula across the object and social domains, since the child's dominant level of functioning should suggest the general class of experiences that he needs to encounter. At the broadest level, the developmental level analysis suggests that we need to ask, in designing an intervention, whether the child simply needs opportunities for contingent perceptual experiences, opportunities for

experiences in acting voluntarily, opportunities for experiences in acting in ways that produce differential feedback that suggests the need for coordination of action, opportunities for experiences in acting in ways that foster an understanding of how the child's actions succeed, or finally, opportunities for a range of exploratory experiences that allow failure as well as success and foster anticipation of the effects of his actions. More research is needed before these notions can be translated into an operational curriculum, but their potential for organizing and directing intervention decisions is great. The specific content of the individual scales could then serve to direct the interventionist in determining the specific experiences for which the child should be provided appropriate opportunities.

All of this remains for now highly speculative, and we are a number of steps away from validation of such a model. In addition, there are other factors essential to informed intervention decisions to which this model is not addressed. The model's primary objective is to provide a framework for asking what the very young child understands about adapting to his physical and social environment and what he must master next to become a more effective problem-solver in his interactions with that environment. Whether this model provides the basis for more effective intervention, in terms of both short term and long term outcomes, is perhaps the most significant question that awaits further research.

Footnote

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